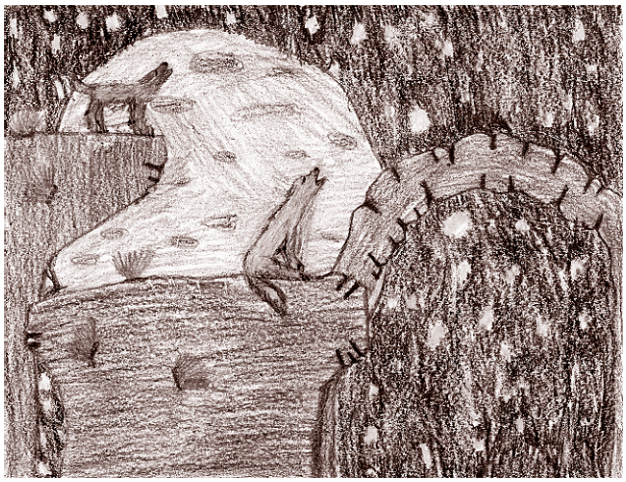
Habitat



ANGELA PHILLIPS

Outline

Theme
Food, water and shelter are primary habitat needs of all animals.

Utah State Science Core Curriculum
Topic: Ecosystems
Standard [3030-01]
Students will:
- Explore ecosystems and discover relationships among living organisms and the nonliving world.
- Compare and contrast similarities and differences of various habitats.
- Describe different food chains within a given habitat.

Suggested Field Trip Locations
The Nature Conservancy Scott M. Matheson Wetlands Preserve in Moab, or any wide riparian area with numerous trees. Avoid winter and early spring, when ants and antlions aren't active.

Background

Habitat is a place with a particular animal's needs. Its components include food, water, shelter, space, and the arrangement of these. Human actions and population increases can cause loss of animal habitat. Most affected are animals with large space needs, or animals with very specific needs. Understanding of habitats increases the ability to avoid habitat loss.

U.S. FISH & WILDLIFE SERVICE/TED SWEM

The peregrine falcon favors sheer cliffs, like those found along the Colorado River, for its nest sites.

Ants are easy to find and fascinating because of their social nature. There are many types, including predators, scavengers, plant-eaters, farmers, and ants that milk honeydew from aphids. Because of the variety of diets, some ants have stingers and many have powerful mouth parts. Many will bite if disturbed. A few, including harvester ants, can inflict powerful stings. Most ants found outside of the nest are female worker ants. Worker ant bodies have three parts, a thin waist, and no wings. Ants communicate by leaving a scent trail, vibrating their bodies, or regurgitating food containing their hormones. Ant antennae are usually bent; they pick up scents and vibrations, and serve as smell, touch, and taste organs. Worker ants have crops for storing liquid food such as nectar or honeydew from aphids. They have strong muscles for moving food.

Antlion larvae make conical pits in fine sand. They burrow backwards into the sand, then use their heads to flip out material, resulting in one- to two-inch diameter pits. An antlion spends most of its life as a half-inch-long larva, waiting buried in the bottom of a pit with its pair of long, specialized hollow jaws protruding from the sand. When an insect prey falls into the pit, the jaws trigger shut. The antlion first injects an anesthesia and digestive enzyme into its prey, then sucks up the prey's dissolved body contents. After a short pupal stage buried in the sand, the antlion short-lived adult stage emerges, looking surprisingly large and resembling a dull brown damselfly. Antlion larvae are harmless to humans; catch them by scooping up a handful of sand beneath a pit. (They re-build pits quickly if disturbed.) Keep them in a cup of sugar; the grain size is perfect and the brown larvae can be easily seen. Feed them ants or other small insects.

Northern flickers are common woodpeckers that live in southeastern Utah year-round. They have strong necks and bills and thick skulls, apparently to avoid knocking themselves out when they peck or drum on trees, branches or houses. They peck and drum to excavate insects from under the bark, to excavate nest sites, and to advertise their territory. Unlike most woodpeckers, flickers spend much time on the ground, mostly locating and excavating anthills. They rely on ants for up to 45 percent of their food (Ryser 1985, 333), more than any other North American bird (Ehrlich and others 1988, 338). Like other woodpeckers, they have a special tongue/bone arrangement for probing into deep crevices and extracting insects. A woodpecker's long tongue at rest wraps up and around the inside of its head. In action, the long, sticky, barb-tipped tongue shoots into a crevice and then retracts back into the bird's mouth, possibly with an insect attached. Woodpeckers may find hidden insects by tapping, then feeling resulting vibrations with the tip of their bill to see if there are tunnels below the bark. Or they may listen for the movement or chewing of their prey (Ryser 1985, 322). Besides ants and other insects, flickers also eat acorns, seeds, nuts, and grains. Flickers and most other woodpeckers have an undulating flight pattern; they fold their wings against their bodies after each series of flaps.

Peregrine falcons became rare due to DDT and other pesticides, which caused eggshell thinning and breakage. Recovery efforts led to a comeback, from a low of about 324 nesting pairs in the U.S. and Canada in 1975, to at least 1650 nesting pairs in 1999. In 1999, peregrines were removed from the federal endangered species list. Though still on the state endangered species list in Utah, it is not uncommon to see them in the canyons of southeastern Utah.

PRE-TRIP ACTIVITY

Habitat research

Adapted from Project WILD 1992, 40-45

PROCEDURE

1) Define and discuss *habitat* and its primary components: *food*, *water*, and *shelter*. Post **Habitat Information Chart**, and model the completion of a habitat column for an animal familiar to the students. Tell students that they are going to have a chance to research an animal's habitat needs.

2) Post or point out the **Suggested Animals for Habitat Research**. Split students into groups of two or three randomly or by animal research interest. One organizational method is to have ten or fifteen books on a counter, each labeled with an animal name. Have students each choose a number, then choose an animal and corresponding book in sequence. Limit three students per book.

3) Distribute a copy of the **Habitat Component Sheet** to each research group. Ask that students complete these and print very clearly, as these sheets will be copied and used in a game that they will play in the post-trip. Assist student groups with their research. Encourage them to learn more details about their animals if they finish early.

4) Have each group present its animal's basic habitat needs to the class, as you or a student clearly prints the results on the **Habitat Information Chart**. If there is time, allow each group to present one additional interesting fact about their animal. Collect completed **Habitat Component Sheets**.

5) Preview upcoming field trip, informing students that they will be exploring the habitat of a few animals in more detail. Review the items that students need to bring to school on the day of their field trip.

OBJECTIVES

Students will be able to:

- Name the primary components of habitat.
- Use literature resources to research animal habitat.

MATERIALS

- **Habitat Information Chart**
- **Suggested Animals for Habitat Research** (Select animals from this list based on available research materials and print on blackboard or overhead transparency)
- Several juvenile resource books and a few adult resource books including habitat information on the suggested animals (especially appropriate are Brady 1998; Skramstad 1992)
- Copies of **Habitat Component Sheet**

TIME

- 30 minutes

PRE-TRIP

HABITAT INFORMATION CHART

Instructions for preparation: On a several-foot-long piece of chart paper, draw the following grid with title, labels and habitat components. Leave space for the 12-15 animal habitat columns, to be completed during the pre-trip and on the field trip. Model the completion of a sample animal's habitat column, such as the beaver column below.

	ANIMALS			
HABITAT COMPONENTS	**Beaver**			
Food	Willow and cottonwood bark; plants			
Water	Freshwater from pond or river			
Shelter	Dens in riverbank, or lodges			

SUGGESTED ANIMALS FOR HABITAT RESEARCH

Select animals from this list based on available research materials and print on blackboard or overhead transparency:

Piñon Mouse
Antelope Ground Squirrel
Harvest Mouse
Chipmunk
Desert Cottontail
Mule Deer
Desert Bighorn Sheep
Hummingbird
Grasshopper
Grey Fox
Ringtail
Coyote
Striped Skunk
Raven
Piñon Jay
Canada Goose
Trout
Mosquito
Mountain Lion
Kit Fox
Badger
Golden or Bald Eagle
Great Horned Owl
Great Blue Heron
Canyon Wren
Rattlesnake
Whiptail Lizard

HABITAT COMPONENT SHEET

Animal	Food
Shelter	Water

Objectives

Students will be able to:
- Explain why ants are called social insects.
- Describe how ants collect food.
- Respond to questions based on personal observations.

Materials

- Pictures of the different stages and castes of ants
- Copies of **Investigating Ants** (two half-sheets, copied back-to-back)
- Clipboards
- Pencils
- Hand lenses
- Crumbs or other small food items
- **Habitat Component Sheet**

Time

- 30 minutes

STATION ONE

Investigating ants

Adapted from Incredible Insects. *1984, 1989, 38-39, 44*

NOTE

Choose an area with numerous anthills. Avoid harvester ants or other types of ants with severe stings or bites.

PROCEDURE

1) Ask students what they know about ants, a question sure to generate enthusiasm. Be sure to convey the social nature of ants. Show a drawing of the different castes within a colony. Discuss different types of ants, having different food needs and correspondingly different abilities or inabilities to bite or sting humans. Show a few pictures if available.

2) Invite students to become investigating scientists to learn more about ants and their habitat. Distribute a clipboard, pencil and **Investigating Ants** half-sheet to each student. Read through and discuss the front of the sheet. Have student pairs or individuals each find an anthill to examine closely, and respond to these questions. Gather students and compare findings for different anthills and different types of ants.

3) Read through and discuss the back of the **Investigating Ants** half-sheet. Have each student pair place and watch one small food item approximately two feet from an anthill. Note the time when the food is placed, in order to answer the first question. If some students' foods are found and others aren't, have students move to found food sources to complete the questions.

4) Clean up food. Gather students and discuss observations. As a group, fill out a **Habitat Component Sheet** for ants.

EXTENSION

Have students complete and color "Copycat Page: An Ant's A-mazing World" (*Incredible Insects*. 1984, 1989, 42), a maze that illustrates the different workers and rooms in an ant colony, along with some of its predators above the ground surface.

Read *The Ant Bully* (Nickle, 1999).

INVESTIGATING ANTS

Adapted from "Ant Detective Worksheet," Incredible Insects. *1984, 1989, 44*

Names _____ Date _____

1. Draw the most common kind of ant at your anthill. Label its color or colors.

2. Are the ants all the same color, size and shape?
   If not, how are they different?

3. Use your hand lens to take a close look at some ants.
   Draw an ant antennae or some other interesting thing you see.

Copy back-to-back with other side and cut along this line.

INVESTIGATING ANTS

Adapted from "Ant Detective Worksheet," Incredible Insects. *1984, 1989, 44*

Names _____ Date _____

1. Draw the most common kind of ant at your anthill. Label its color or colors.

2. Are the ants all the same color, size and shape?
   If not, how are they different?

3. Use your hand lens to take a close look at some ants.
   Draw an ant antennae or some other interesting thing you see.

4. What type of food did you place?

5. Did the ants find your food?

6. How long did it take for them to discover it?

7. Did the first ants at the food communicate to other ants that they had found food?
   If so, how did they communicate?

8. Are the ants carrying the food?
   If so, how are they carrying it?

9. How are ants interacting if there are more than one at the food?

10. Write or draw one other interesting thing you noticed while watching the ants.

Copy back-to-back with other side and cut along this line.

4. What type of food did you place?

5. Did the ants find your food?

6. How long did it take for them to discover it?

7. Did the first ants at the food communicate to other ants that they had found food?
   If so, how did they communicate?

8. Are the ants carrying the food?
   If so, how are they carrying it?

9. How are ants interacting if there are more than one at the food?

10. Write or draw one other interesting thing you noticed while watching the ants.

STATION TWO

Antlion antics

PROCEDURE

1) Ask if anyone wants to hold a tickly antlion larva. Have each volunteer hold out a hand low over a tub or tarp with fingers tight together, before placing the antlion in the hand for a few seconds. Encourage but don't force all students to take a turn. Encourage observations about the larva's appearance and behavior. Have students gather and watch the antlion burrow when placed in a cup of sugar. Set cup aside where it won't be disturbed. Incorporate former student knowledge in an introduction to antlion strategy for capturing and eating (drinking) its prey. Describe the brief pupal and adult stages of the antlion life cycle. Show pictures of the antlion larva and adult. Explain that students will observe and do two experiments to learn more about antlion food and shelter needs.

2) Explain that antlions eat other insects besides ants, and that size of insect is more important to them than type of insect. Tell students their first experiment will explore the question "What sizes of insects do antlions catch most often?" Ask for predictions. Explain that the procedure will involve catching some insects, measuring them, dropping them in antlion pits, and watching to see which ones are caught. Pair students and give each pair a bug box. Assign each pair to capture a few small insects. When they return, choose a range of sizes of insects, leaving two insects for each pair and letting the others go. Distribute a clipboard and copy of **Antlion Habitat: Prey Size and Grain Size** to each pair, and guide them in measuring and recording in millimeters the sizes of their insects. Have one pair at a time drop an insect into a pit while the whole group watches. Wait until insect has been captured or has escaped before going on to the next pit and drop. Record whether or not the prey was captured, next to its measurement on its sheet. Discuss results and conclusions, and factors not considered, such as luck and antlion size.

3) Tell students that to explore the shelter component of antlion habitat, we will ask the question "What grain size does the antlion prefer for its pits?" Ask each student pair to locate three pits and record grain size, comparing to the grain sizes illustrated on the sheet. Coordinate so that different pairs don't measure the same pits. Compare results.

4) As a group, fill out a **Habitat Component Sheet** for antlions, including preferred insect size and grain size. Look at the cup set aside earlier to see if the antlion has finished its pit excavation.

OBJECTIVES

Students will be able to:
- Describe what antlions eat and how they capture their food.
- Record data based on first-hand observations.

MATERIALS

- Antlions for handling
- Cup of sugar
- Pictures of antlion larva and adult
- Occupied antlion pits (If not plentiful, supplement with previously captured antlions each in a cup of sugar, undisturbed long enough for pit excavation)
- Bug magnifying boxes
- Metric rulers
- Clipboards
- Pencils
- Copies of **Antlion Habitat: Prey Size and Grain Size**
- Hand lenses
- **Habitat Component Sheet**

TIME

- 30 minutes

STATION 2

ANTLION HABITAT: PREY SIZE AND GRAIN SIZE

Names _____ Date _____

PART 1: PREY SIZE

Prey Insect Length	Captured?
1)	
2)	
3)	

Copy back-to-back with opposite page and cut along this line.

ANTLION HABITAT: PREY SIZE AND GRAIN SIZE

Names _____ Date _____

PART 1: PREY SIZE

Prey Insect Length	Captured?
1)	
2)	
3)	

Copy back-to-back with opposite page and cut along this line.

ANTLION HABITAT: PREY SIZE AND GRAIN SIZE

Names _____ Date _____

PART 1: PREY SIZE

Prey Insect Length	Captured?
1)	
2)	
3)	

PART 2. GRAIN SIZE

Circle grain size at each antlion pit.

Pit #1	silt	fine sand	medium sand	coarse sand
Pit #2	silt	fine sand	medium sand	coarse sand
Pit #3	silt	fine sand	medium sand	coarse sand

Copy back-to-back with opposite page and cut along this line.

PART 2. GRAIN SIZE

Circle grain size at each antlion pit.

Pit #1	silt	fine sand	medium sand	coarse sand
Pit #2	silt	fine sand	medium sand	coarse sand
Pit #3	silt	fine sand	medium sand	coarse sand

Copy back-to-back with opposite page and cut along this line.

PART 2. GRAIN SIZE

Circle grain size at each antlion pit.

Pit #1	silt	fine sand	medium sand	coarse sand
Pit #2	silt	fine sand	medium sand	coarse sand
Pit #3	silt	fine sand	medium sand	coarse sand

Objectives

Students will be able to:
- Describe the food and shelter needs of flickers.
- Describe two identifying characteristics of flickers.

Materials

- Pictures of northern flickers
- Drawings of woodpecker head, with tongue relaxed and extended
- Small tagboard or foil cutouts of ants
- Small cardboard box with two or three holes (slightly larger than the size of the ants) punched in it
- Two sticks or pencils with scotch tape wrapped around end, sticky-side out
- Extra scotch tape
- **Habitat Component Sheet**
- (optional) Cassette player and cassette tape of flicker calls

Time

- 30 minutes

STATION THREE

Flicker favorites

NOTE

Scout the area in advance for flicker activity and woodpecker holes in trees.

PROCEDURE

1) Show students a picture of a northern flicker and explain that it is a common type of woodpecker that especially likes to eat ants. Point out its characteristic white rump patch, red underwings, and chest and head markings. Discuss its habit of pecking and drumming on trees, and tell students about its thick skull and strong pointed bill. Explain that it pecks to find insects and to excavate nest holes, and that it usually uses dead trees for its nests.

2) Describe the woodpeckers' unusual undulating flight pattern. With the students, imitate the flight pattern, running as they flap their arms three times, then dipping down as they run to imitate a glide. Start them together at one end of a runway, saying "Flap, flap, flap, glide; flap, flap, flap, glide..."

3) Have students sit down again, and show the two pictures of woodpeckers' heads, with tongue relaxed and extended. Explain that the tongue is sticky and barbed on the end. Have students each take a turn at trying to capture cutout insects from inside the small cardboard box, using the sticky-ended pencil. You may have other students count to ten for each student turn.

4) Imitate or play a cassette tape of flicker calls if possible. (If the field trip is during spring nesting season, play tape very quietly, or not at all, to avoid disturbing the birds' nesting behaviors). Then go on a walk to look and listen for flickers, and to look for possible flicker nest holes in the trees. Discuss where a flicker in this area could find water. Either at the beginning or some other point in the walk, have the students walk or sit in silence, listening for flicker calls.

5) To review, as a group fill out a **Habitat Component Sheet** for the flicker. Discuss key characteristics of flicker habitat and lifestyle.

STATION 3

STATION FOUR

Falcon Feasting

NOTE

An extra adult is needed to dress up as a colorful bird. Include a bright cloth or jacket draped over arms as wings, a "tail" tucked into a waistband, and a bright stocking cap for a colorful crown or head. The "bird" should hide near the group and come out on cue, imitating the behavior of a particular bird.

PROCEDURE

1) Ask students to sit for a story (adapted from Andy Nettel, pers. comm.):

A boy named John was growing up in the eastern United States in the 1960s. He liked exploring outdoors, and became particularly interested in birds. It became his hobby to look for birds, and try to figure out what kind they were.

2) Interrupt the story and show a simple drawing of a generic bird with key parts labeled. Discuss field markings, behavior and flight patterns to look for when trying to identify birds. At this point, a dressed-up human bird should come from behind shrubbery nearby for just a few seconds. When he disappears, ask students if they saw any field marks. When the "bird" comes out again, ask questions about field marks and behavior. The bird may disappear, remove costume, and re-join the group. Meanwhile, discuss a few ways of recognizing birds of prey, then resume the story of John:

After a few years of birdwatching, John saw a bird of prey that he hadn't seen before. It had a quick flight, and long, narrow, angled wings. He looked as his bird identification book, and finally decided it was a peregrine falcon. He had begun going to the local bird club meetings each month. Most of the time he sat quietly and listened to the mostly adult group, but the first time he went after seeing the falcon, he spoke up and told the group he'd seen a peregrine. He was shocked by their response: They looked at him sadly and said it couldn't have been a peregrine; there were no more peregrine falcons left. And it was true; there were a few left in the western U.S., but they were totally gone in the eastern U.S. by 1970. They were almost extinct.

3) Discuss the meaning of *extinct*. Show pictures of peregrines. Tell the group about peregrine falcon biology, natural history, and habitat, and a simple history of their plight. Explain that steep buildings in cities provide a habitat similar to steep canyon walls, with pigeons replacing the birds they would hunt in the wild. Describe the raising and hacking of peregrines. Tell students that peregrines have recovered enough that they were taken off the national endangered species list in 1999.

4) Finish the story about John:

John is now a man. He had still never seen a real peregrine falcon. Then a couple years ago, he went on a trip to visit an old friend. They went out hiking on a few different days. Finally, the evening before John was going to return home, just before dark, he saw a peregrine fly over. John said that seeing that peregrine made this the best vacation of his life. The friend he was visiting was a ranger in Arches National Park, and he saw that peregrine along the Colorado River near Moab.

5) Inform students that pergerines can sometimes be seen from the wetlands, and even flying over Moab. Point out nearby cliffs as the type of place they nest. Point out whitewash to look for when looking for birds' nests.

OBJECTIVES

Students will be able to:

- Describe two characteristics or behaviors of peregrine falcons.
- Name the habitat components for peregrine falcons.
- Name at least one factor that helped peregrine populations recover.

MATERIALS

- Bright clothing and stocking cap for bird costume
- Generic drawing of a bird with parts labeled
- Pictures of peregrine falcons
- Binoculars
- Two copies of each **Raptor Prey Card**
- **Habitat Component Sheet**

TIME

- 30 minutes

STATION 4

6) Show students how to use binoculars. Take a quiet walk, looking for birds and their field marks. Insist that students walk for at least a few minutes quietly and without talking. Have students point out any birds they see. After a few minutes, you might have students pretend to be peregrines looking for birds to eat.

7) Tell students you have some things that peregrines and other raptors eat. Pull out one **Raptor Prey Card** at a time, discussing which birds of prey might eat it. Divide students into two relay teams. Place **Prey Cards** at the far end of the relay run. Call out a raptor name, and have first student in each team run to pick up an appropriate raptor card. Upon return, teammates give a thumbs-up or send teammate back for a different card.

Prey	Likely Bird of Prey Predators
Duck	Peregrine Falcon, Golden Eagle, Bald Eagle
Cliff Swallow	Peregrine Falcon
Prairie Dog	Golden Eagle, Bald Eagle
Grasshopper	Kestrel
Desert Cottontail	Red-tailed Hawk, Golden Eagle
Fish	Bald Eagle
Sparrow	Sharp-shinned Hawk, Cooper's Hawk, Peregrine Falcon
Kangaroo Rat	Red-Tailed Hawk, Kestrel

8) Review some key points about peregrines, and fill out a **Habitat Component Sheet**.

GARRETT GORDON

RAPTOR PREY CARDS

Make two copies of each on tagboard, and cut apart along lines.

DUCK	CLIFF SWALLOW
PRAIRIE DOG	GRASSHOPPER
DESERT COTTONTAIL	FISH
SPARROW	KANGAROO RAT

Objectives

Students will be able to:

- Name the primary components of habitat.
- Describe the habitat of several area animals.

Materials

- **Habitat Information Chart** from pre-trip
- **Habitat Component Sheets** from pre-trip and one from each field trip station, copied on a different color paper or tagboard for each card-playing group and cut into quarters

Time

- 30 minutes

POST-TRIP

POST-TRIP ACTIVITY

Habitat go fish

Adapted from Project WILD 1992, 40-45

PROCEDURE

1) Review the four field trip stations, using a **Habitat Component Sheet** from each station. Add a column to the **Habitat Information Chart** as you review each station. Discuss food chains and the variations on a food chain encountered on the field trip. Briefly discuss loss of habitat due to human actions. Using examples from the chart, convey the general (though not universal) rule that habitat of large animals is more easily disturbed or destroyed than that of small animals.

2) Inform students that the upcoming game is similar to *Go Fish*, except that the goal is to obtain as many complete sets of habitat cards for one animal as possible. Review the rules of *Go Fish* (or have a student do this). Remind students that they may refer to the Habitat Information Chart to be sure they have a complete set of *animal* and corresponding *food*, *water* and *shelter*.

3) Divide students into groups of about four, and distribute one complete set of habitat cards to each group. Begin play, assisting students in getting started.

4) Leave **Habitat Information Chart** posted in the classroom for awhile for student reference. You may wish to save the game cards and play again at a later date, to reinforce student learning.

References and Resources

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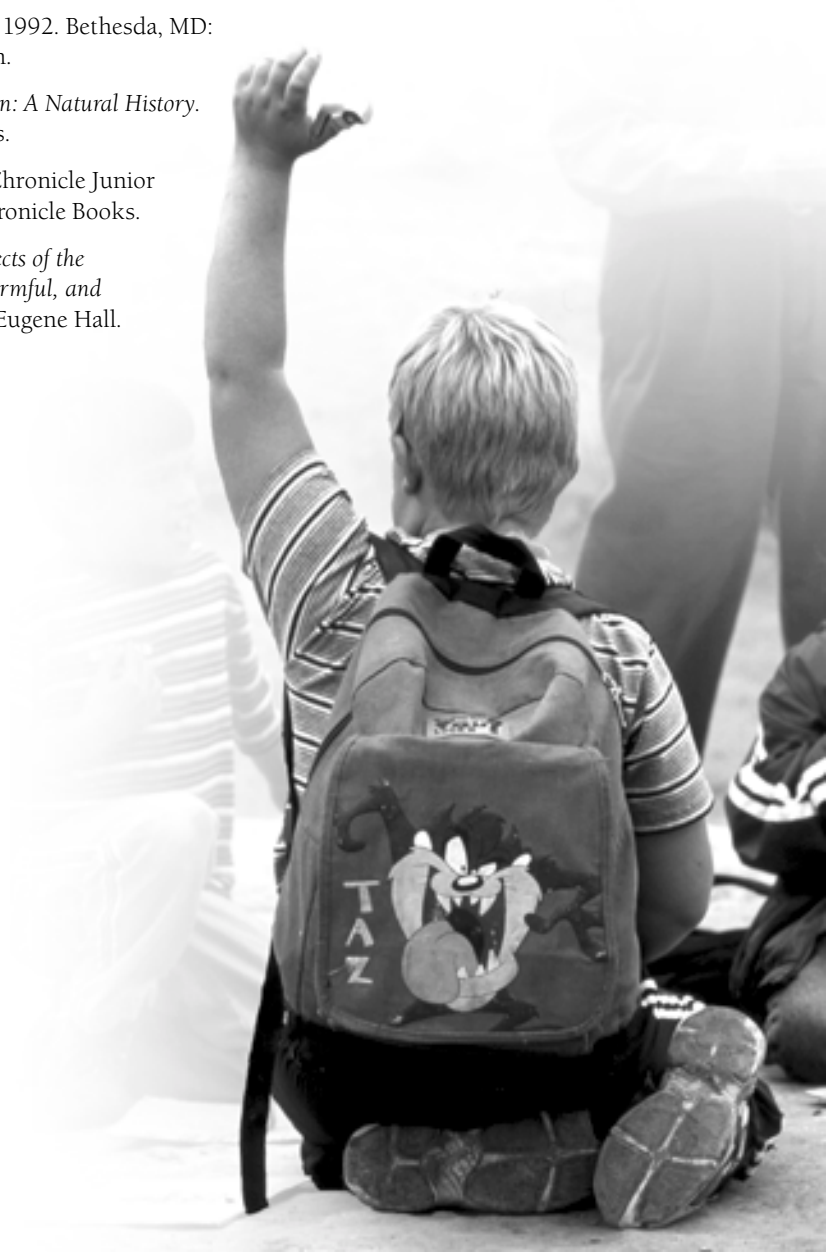
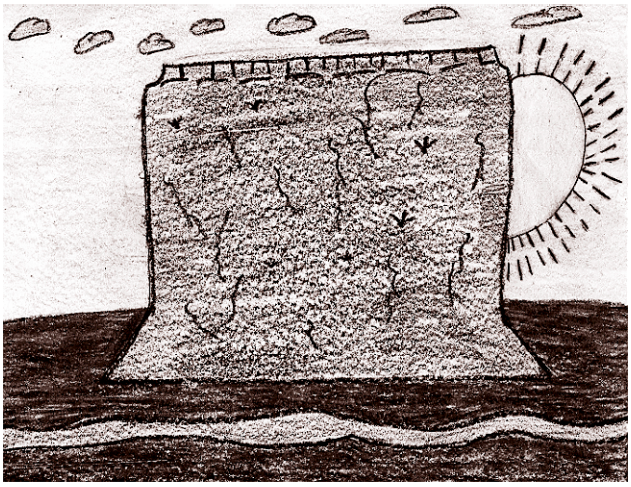


Geological Features



RACHAEL NICCOL COPLIN

Outline

Theme
Recognizing geological features and understanding the use of maps and compasses helps us travel safely in the desert.

Utah State Science and Social Studies Core Curriculum
Topics: Geological Features and Geographical Concepts.
Standard [3030-03]: *Students will recognize various geological features and investigate geological processes.*
Standard [6030-04]: *Students will understand geographic concepts (landform, map and compass use).*

Suggested Field Trip Locations
Park Avenue near Courthouse Towers parking area, Arches National Park. Other sites with at least a few prominent physical features may be used if regional map, local map, and clue cards are adapted to the area.

Background

Water was the key factor in forming the odd and beautiful sandstone spires, balanced rocks, arches, buttes and mesas of Arches National Park and vicinity. Blowing sand, chemical reactions, and winter temperature fluctuations above and below freezing also contributed to the erosional processes that created the features. The rock layers in Arches are 200 to 300 million years old; erosional forces have been at work on them primarily in the last 10 million years. In another million years, perhaps some of the arches and spires we see today will be gone.

Park Avenue in Arches National Park is an ideal location for this field trip.

Weathering and erosion begin with water between sand grains in a rock. The water may be slightly acidic (as most rainwater is), and chemically dissolve the natural rock cement between the grains. The large temperature fluctuations between day and night during the high desert winters repeatedly freezes the water, causing it to expand and break apart the surrounding grains. Loosened sand grains and rock particles fall, blow, or are washed off the rock. Runoff after rainstorms carries the sediments downslope to the nearest wash, and eventually down the Colorado River to the Gulf of California (with long stops in Lake Powell and Lake Mead along the way). Water does more to wear away the land than all other geologic agents combined. But wind, ice and gravity also have important roles in shaping the landscape.

For the first-time visitor to a national park or other area, an orientation map such as that contained in a park brochure is a must. On the map, visitors find the names and locations of geological features, points of interest, roads, and trails. A map key or legend includes a guide to the symbols used in the map, as well as a scale and a north arrow. The map can be oriented, using either a compass or the recognition of two features on a map.

But to get to know the area intimately, as one does in hiking, a topographic (topo) map is more useful. A topo map has contour lines that represent specific elevations. The contour lines are spaced at a named interval, and every fifth line is dark for easier reading. With practice, a map-reader can recognize a large variety of features and landforms from the orientations and spacing of contour lines. For example, close spacing of lines represents steep features, and Vs represent either drainages (Valleys) or ridges.

Compasses are valuable orientation tools, especially in cloudy weather, or when views are obstructed by vegetation. Be careful not to use compasses near other compasses, metals, or even metallic rocks. Compass needles usually align themselves with the earth's magnetic field, but can be thrown off by these objects. Assuming a compass isn't near a local deflector, its needle will point toward the northern magnetic pole, where the earth's magnetic lines converge.

For safe hiking in the high desert, map-reading and compass-reading are two necessary skills. Necessary items to have in a pack on a desert hike besides map and compass are water, food, and extra clothing. Matches and a flashlight are also a good idea, especially in the winter. It is also important that hikers tell someone where they plan to go before they leave on a hike. Hikers should pay attention to landmarks and occasionally look at these over their shoulders.

The following steps should be taken if you become lost while hiking: Stay calm and try to reorient yourself. Look for known features or landmarks. If possible, retrace your steps. If you cannot, or if you become confused, stop and wait to be found. Try to find a bit of shade, or a place out of the wind, depending on the weather conditions. But be sure you or some of your colorful gear is visible, and periodically make some noise, so that you won't be missed when someone comes looking for you. In summary, when lost: Stay calm; Stay put; and Seek Shelter.

PRE-TRIP ACTIVITY

Traveling safely in the desert

PROCEDURE

1) Introduce the field trip by printing *Traveling Safely* on the board. Underneath, print three things students will be learning about on the field trip: *maps*, *compasses*, and *landmarks*. Briefly discuss and relate each to the idea of traveling safely.

2) Ask students what the four cardinal directions are. Place the four directional cards on the corresponding four walls of the classroom. Have students stand by their seats for a quick round of Direction Freeze. Say a direction and have students face that direction by the time you say "Freeze!" You may ask students to sit down if they are facing the incorrect direction. Increase pace.

3) Ask students to listen closely to a story, and listen for any mistakes as well as good decisions that the girl in the story makes. Read "Lost in the Red Rocks." Have students list Claire's mistakes and discuss each, including not paying attention to where she was going and to directions. Discuss what Claire could have done and taken with her to make her journey safer.

4) Preview upcoming field trip, including agenda and behavioral expectations. Review the items that students need to bring to school on the day of their field trip.

EVALUATION

Have students create a lost hiker story or dramatization. Tell them to include what the hiker did to be found, or to find his way, including the use of landmarks.

OBJECTIVES

Students will be able to:

- Name two items to take along for a safe hike.
- Name two safe responses if one becomes lost outdoors.
- List the four cardinal directions.

MATERIALS

- **"Lost in the Red Rocks"** (adapted from Discovering Deserts 1985, 48-50)
- Four cards with one cardinal direction, *N*, *E*, *S* or *W*, printed on each

TIME

- 30 minutes

PRE-TRIP

Lost in the Red Rocks

Adapted from Discovering Deserts *1985, 48-50*

Claire was excited. Her parents had spoken of the red-rock canyons of southern Utah for years, and especially during the last month as they made plans for their trip here, but she hadn't paid a lot of attention. But when they drove down the road leading to the Needles District of Canyonlands National Park, she couldn't believe her eyes. She had never seen anything like these red and white sandstone cliffs and shapes. By the time they got to the campground it was getting dark, so exploring had to wait until morning.

Now it was morning, her parents were asleep, and she was ready to go. Rather than wake her parents, she decided to go on a short exploration of her own. She decided breakfast could wait, and started up a trail near the campground. She thrilled in the colors of the sunrise and in the unfamiliar yuccas, cacti and twisted juniper trees. As it warmed up, she wished she had worn her baseball cap.

A lizard scampering across the trail interrupted this thought. Claire left the trail in pursuit of a better look. She lost sight of the lizard, but followed its tracks in the fine sand. The tracks went into a slot in the sandstone! The slot was so tempting, just big enough for Claire to squeeze through. It led to a steep slickrock slope to the top of a flat layer of sandstone. Claire climbed up.

After walking around on the sandstone ledge and taking in the view, she realized she was getting hungry, and very thirsty. Even though it was still morning, it was HOT out here. She decided to find her way back to the campground. Soon she realized that the ledge she was on dropped off in a vertical cliff on most sides. She started in the direction where she thought the slope she'd come up was, but found higher cliffs instead. She began to panic, and run along the cliff edge. But her toe caught a rock, and she fell. Her ankle hurt, and she decided to stop and wait to be found. She moved into the shade of a nearby rock.

Before long she heard a human voice. She began shouting, and her mother answered back! Very relieved, she thought of breakfast, a cold drink of water, and hiking with her parents next time.

MISTAKES OR BAD DECISIONS

- Hiking by herself without telling anyone where she was going.
- Not wearing a hat, or taking water, food, a map or a compass.
- Not paying attention to directions and landmarks.
- Panicking when she realized she was lost.

GOOD DECISIONS

- Waiting in the shade once she hurt her ankle.
- Yelling when she heard voices.

STATION ONE

Create a feature

PROCEDURE

1) Ask how many students would believe you if you told them that there was once solid sandstone covering this whole area, higher than the tallest pinnacle they can now see, and that these weird shapes of sandstone around them are the leftover remnants of that. Tell those who raise their hands that they are correct! Emphasize that these sandstone features did not grow out of the ground. Create a model demonstrating their formation process. Place differently shaped rocks (sandstone) in a three-sided plastic tub, then fill the tub with loose sand. Pour water over the sand, washing some of it away and exposing the harder underlying rocks. Emphasize that this is a model, with the loose sand representing the sandstone that once covered this area and the rocks representing harder areas in the sandstone. Clarify that the model is a *fast* demonstration, representing hundreds of thousands of rainstorms and thousands of years of erosion.

2) Tell students that they are now going to have a chance to use clay to sculpt one of the sandstone features within view. Explain that their goal is to make it look as much like the real thing as they can, and that they may build the features up from the ground, even though we now know that that's not how they formed. Ask students to work in secret, without revealing their features to the other students. Pass out cardboard working surfaces and clay, and spread students over a small area to work.

3) When everyone is finished, have the students bring their features to a central area. Have each student take a turn displaying his sculpted feature and calling on other students to try to name it.

EVALUATION

Have students build and demonstrate their own erosional models, similar to the one in the field trip.

Instruct students to sculpt other physical features out of clay. Again have other students try to recognize and name the clay sculptures.

OBJECTIVES

Students will be able to:
- Briefly explain how the geologic features around the field trip site formed.
- Build a model of a geologic feature.

MATERIALS

- Photograph of flash-flooding stream
- Rectangular plastic dish tub with one of its smaller sides cut out
- Small pieces of sandstone for model
- Water (at least two gallons for four groups)
- Clay
- Cardboard pieces to use as working surfaces

TIME

- 30 minutes

STATION 1

Objectives

Students will be able to:
- Operate a compass using north as a reference.
- Follow a simple compass course.

Materials

- Compasses (one per student)
- **Dr. Find-A-Way Clue Cards**

Time

- 30 minutes

STATION TWO

Dr. Find-a-way

NOTE

Set up **Clue Cards** before the station begins. Note that this station is an introduction to compasses and does not differentiate between geographic north and magnetic north.

PROCEDURE

1) Introduce yourself as Dr. Find-A-Way, and tell students that you are going to introduce them to a tool that will help them find their way when out hiking. Show them a compass, and discuss its uses. Ask if the students have ever used one before or known anyone that has, and when a hiker might need one. Ask why a hunter, or a sailor in foggy conditions, might use one.

2) Distribute a compass to each student. Have students stand with the compasses against their bellies and then turn their bodies so that the compass arrow points away from them. Inform them that they are now facing north. Tell them to put *Jack*, the arrow (red on most compasses), in Jack's red house. Have them face a specific nearby geologic feature and again put Jack in his house. The new number on the compass is the *bearing* from them to the feature. Take bearings together on several features. Discuss how taking a bearing on a distant feature could help you find your way. Emphasize the need to use tall features for bearings when negotiating irregular terrain.

3) Start the students on the compass course by showing them the first **Dr. Find-A-Way Clue Card** or giving them a verbal clue to the location of the first **Clue Card**. Have them take turns reading clues, and have them stay together. At the end of the course, refer back to the lost hiker of the pre-trip activity. Discuss the other things besides food that they would take on a hike in order to be safe, including water, proper clothing, hat, extra clothes, map, and compass. Discuss what they should do if they ever become lost. Summarize as *Stay calm*, *Stay put* and *Seek shelter*. Discuss how the students used their compasses to get through the compass course. Review other situations in which a compass would come in handy.

EVALUATION

Have students come up with a course of their own and draw an approximate map of the course. Instruct them to re-walk the course to check its accuracy, and come up with ideas for improving the accuracy.

DR. FIND-A-WAY CLUE CARDS

Copy onto tagboard and cut apart along lines.

Clue #1

Compass bearing
to the next clue:
130°

Distance: 23 steps

Clue #2

Good navigating!

320°
10 steps

Clue #3

You made it!

140°
29 steps

Clue #4

Good job!

255°
19 steps

Clue #5

You are compass experts!

355°
36 steps

Clue #6

Congratulations!

You have found your way
through the compass course!

Objectives

Students will be able to:
- Identify groups of contour lines that represent steep areas.

Materials

- Topographic map of Arches National Park
- Pan of water and a rock with contour lines marked on it from the water up, in one-inch intervals
- Roll of masking tape
- Two 12-inch rulers
- Two topographic models with stepped-sides, made from stacked, cut pieces of foamboard (one model a hill, and the other a canyon or valley)
- Paper, clipboard, and pencil for each student

Time

- 30 minutes

STATION THREE

Making sense of lumps and squiggles

NOTE

Station #3 is designed to precede Station #4.

PROCEDURE

1) Have students gather around the topographic map of Arches National Park. Point out Moab, the road into the park, the trail down Park Avenue, and the station location on the map. Point out the squiggly lines on the map, and have each of the students read one of the numbers along a line. Explain that the squiggly lines are called *contour lines*, *topographic lines* or *topo lines*.

2) Ask if any students have been to the ocean or to a lake, and convince them that the top of the water (minus waves) is flat. Use the pan of water to illustrate this concept. Explain that because the oceans are connected, the top of the oceans is at the same level, called *sea level*, all over the world. Refer back to the numbers they read on the contour lines, and tell them that Arches National Park is that many feet higher than sea level. Place the rock in the pan of water and describe the meaning of the contour lines on it. Have each student take a turn looking down on the rock to get a *map view* or *top view* of the rock and contour lines. Ask each to point to a side of the rock where lines are close together from this viewpoint, and comment each time that this is a steep side. Have each look again from above and point out a side where lines are farther apart. Have students notice that the contour lines never cross, though they are sometimes very close.

3) Choose a student to contour, and two students to help with measuring. Have the other students monitor. Stand the first student in a flat place, and ask her to stand still with arms at her side. Inform the group that the ground under her feet will be our base level (instead of sea level). Place a ring of masking tape around her at ground level. Have two measurers use rulers to measure up one foot on the right and left side of her body, and use the rulers as a guide in placing the one-foot contour tape. Continue with measuring and taping in one-foot intervals until you reach the top of the student's head. Discuss the height of the contoured student.

4) Hand out paper, pencil and a clipboard to each student. Show the molded foam topographic models, and review the concept of contour lines as needed. Instruct students to look at one of the models from above and draw what the lines look like. Have students break into two groups around the two models. Circulate and help students. Compare drawings within and between groups. Point out the V-shapes of contour lines in valleys, and closed circular or oval shapes of hills or peaks. Collect materials. If there's time, look for similar shapes on the Arches topo map.

STATION 3

STATION FOUR

Matching features and contour lines

NOTE

Station #3 is designed to precede Station #4.

PROCEDURE

1) Review what students learned about topographic maps and contour lines in Station #3.

2) Show poster of a camera's view of five physical features. Have each student point to a place on one of the photographs that would have contour lines close together. Show the poster of contour lines, which show a bird's view, or map view. Have students take turns matching a set of contour lines to a photograph of a feature. Discuss each.

3) Distribute paper, pencil and a clipboard to each student. Instruct students to draw one of the two clay models (as they drew a molded foam model in Station #3). Circulate and help students. When they are finished, again compare drawings within and between groups. Ask students if they made any new discoveries about topographic maps or contour lines.

4) Look at the topographic map of Arches for circular or oval hills or ridges, "V" valleys or washes, steep places and relatively flat places. Show a **Detailed Topographic Map of Courthouse Towers Area** to the group. Compare map scales, and show the location of the detailed map on the Arches map. Distribute a copy of the detailed map to each student. Orient by having students face north and hold their maps so they can read them. Work with students to identify the surrounding physical features on the map. Use named and unnamed features. Discuss how the map could help them find their way in this area (even if they didn't have a compass). Walk into wash and see if you can identify a turn in the wash on the map.

5) To review learning in this and the last station, ask each student to name a different thing that they learned. Prompt with questions if necessary.

EVALUATION

Make copies of a topographic map centered on your school that includes features within view of the schoolyard. Distribute them to each student or pair of students. From the schoolyard, have students label the features. Individually provide names of any feature that a student can't name but can point out.

OBJECTIVES

Students will be able to:
- Recognize that contour lines describe the shape of the land surface.
- Match distinct physical features to corresponding contour lines on a topographic map.

MATERIALS

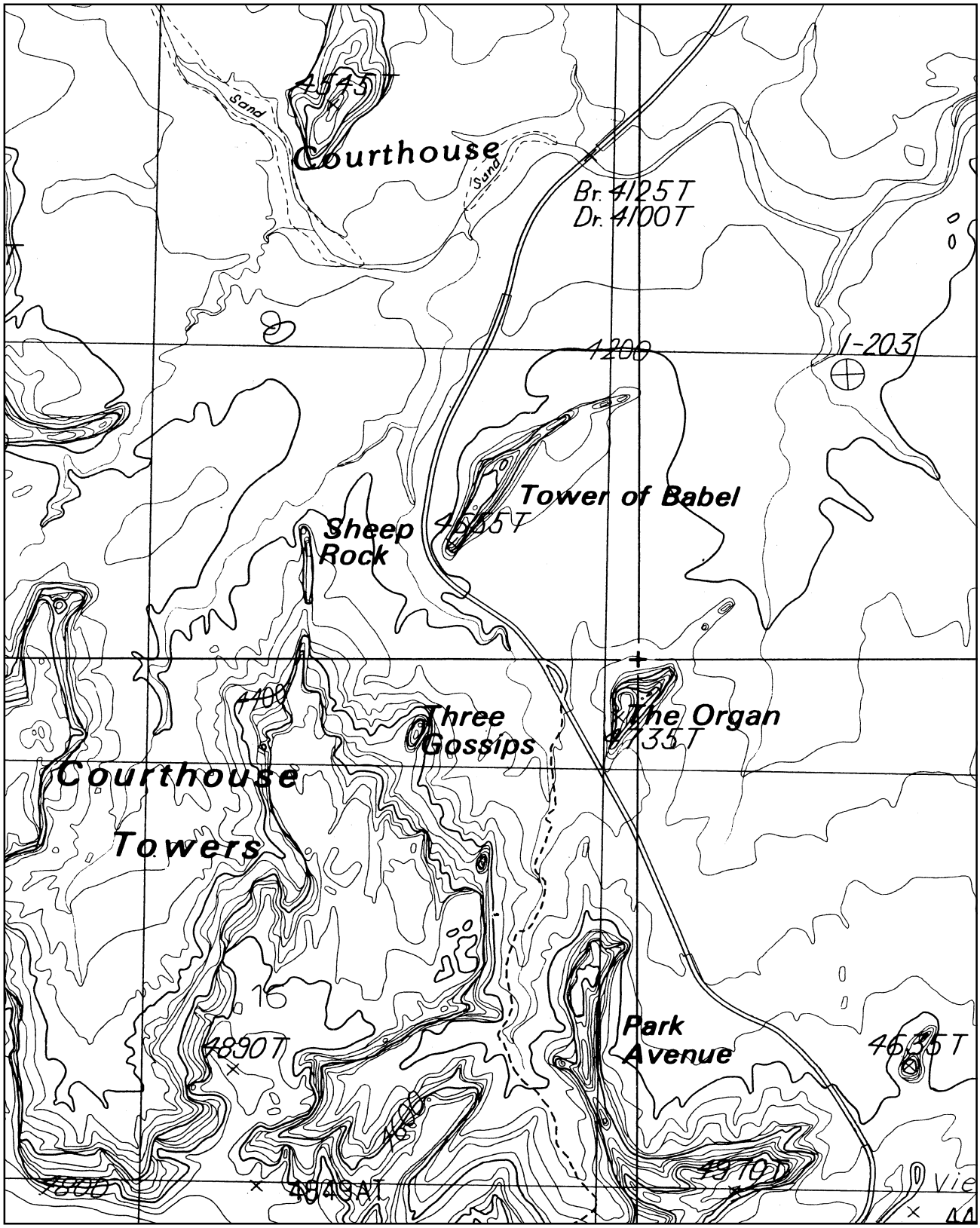
- Corresponding posters of simplified sets of contour lines and photographs of physical features
- Clay topographic models of two different features, on cardboard bases
- Paper, pencil and clipboard for each student
- Topographic map of Arches National Park
- **Detailed Topographic Map of Courthouse Towers Area** for each student

TIME

- 30 minutes

STATION 4

DETAILED TOPOGRAPHIC MAP OF COURTHOUSE TOWERS AREA, ARCHES NATIONAL PARK



POST-TRIP ACTIVITY

Bringing it back to school

PROCEDURE

1) Review the field trip with students, including the theme of traveling safely and the topic of each learning station. Discuss what they might put in their packs for a safe trip in the desert, besides the map and compass they learned about on the field trip. Be sure that they name *water*, *food*, and *extra clothes*.

2) Discuss how a map of the school or the classroom would help new students during their first days at the school. Have students pretend that Claire (from the pre-trip story) will be a new student in their classroom tomorrow. Instruct students to each create a map of the classroom for Claire. Pass out map templates, asking students to only write their names on the top. Have students point north, and then choose two students to check the direction by using a compass. Draw map template on board, and label north in the correct direction, so that maps can be facing upright on desks and be oriented. With class input, label the other three compass rose directions. Ask students to name an important "landmark" in the classroom, and place a symbol for it on the blackboard map. On the key, draw the symbol and write the name of the landmark next to the symbol. Model the mapping of one more landmark on the blackboard map. Ask students to name other landmarks that could be included (and useful to Claire), and print a list of them on the board (*teacher's desk, coat closet, pencil sharpener, sink*, etc.). Ask students to map as many useful landmarks as they have time for, choosing from those on the list or others.

3) Circulate and check each student's work quickly at first, to catch any misperceptions early.

EVALUATION

Review maps, checking for a key and for correctly placed landmarks and cardinal directions.

Have students create a story about a safe journey in the desert or in their schoolyard.

OBJECTIVES

Students will be able to:

- Draw a map that includes a key, cardinal directions, and classroom landmarks.
- Identify at least two uses of maps.

MATERIALS

- Half-sheet copies of the map template: **Map of _____'s Classroom**

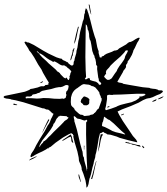
TIME

- 40 minutes

POST-TRIP

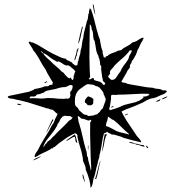
MAP OF _____ 'S CLASSROOM

KEY



MAP OF _____ 'S CLASSROOM

KEY



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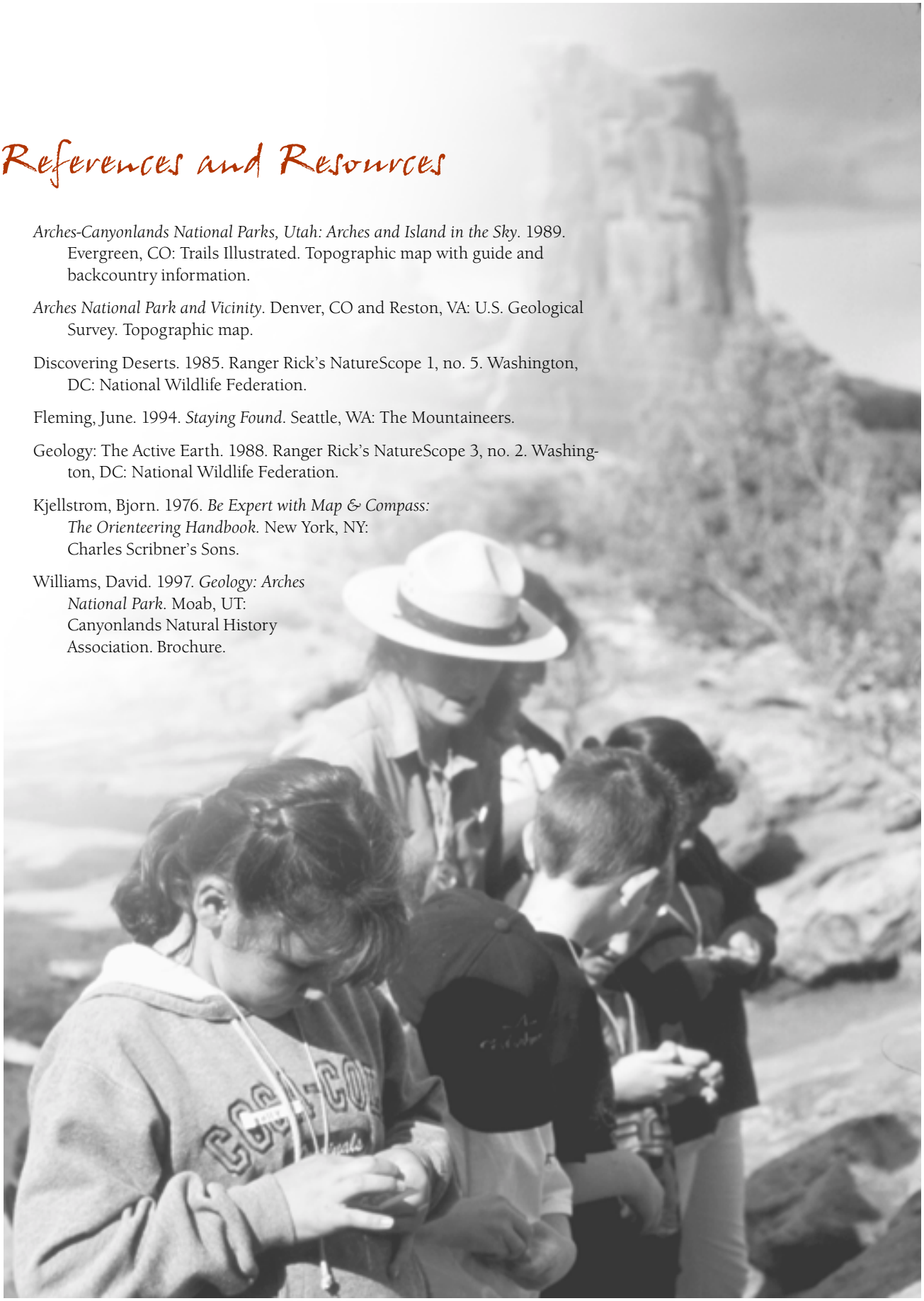

Ecosystems

KELLEN DAY

Outline

Theme
All things, living and non-living, are constantly interacting with one another.

Utah State Science Core Curriculum
Topics: Ecosystems
Standard [3030-01]: *Students will explore ecosystems and discover relationships among living organisms and the nonliving world.*

Suggested Field Trip Locations
Any area with some cryptobiotic soil, a variety of plants, and evidence of animals. A dry wash is usually diverse enough, and is an easy place to manage students without negatively impacting cryptobiotic soil or plants. Any season.

Background

An ecosystem can be defined as all the living and non-living things in a given area. The non-living things include climate (weather, temperature, rainfall), geology (rocks, soil types), and geography (location of vegetation communities, exposure to elements, location of food and water sources relative to shelter sites). An ecosystem is commonly a large area and can include many square miles of land, or water. It includes many interconnected habitats. The most important thing to emphasize about an ecosystem is that all the members (living and non-living) are connected, and that changes in one habitat or organism cause changes in another. Some relationships between members are direct and obvious. Other relationships are not so obvious.

DAMIAN FAGAN

Pronghorn (antelope) require large, open spaces and are usually found in grasslands and mixed desert shrub communities.

A natural community is composed of plants and animals living and interacting within an area that has similar physical characteristics throughout. A community is usually defined by its predominant vegetation, and may be named for that vegetation. Some of the communities of southeastern Utah are Lowland Riparian, Mixed Desert Shrub, Sand Desert Shrub, Blackbrush, Piñon-Juniper Woodland and Ponderosa Pine (Fagan 1998, 9-10). Most of these communities respond to basic desert ecosystem conditions: not much water (aridity), hot summer days, cold winter nights, and wind.

A food chain represents the transfer of energy from the sun to organisms. Producers are green plants that use the sun's energy directly. Primary consumers, herbivores, feed directly on the producers. Secondary consumers, carnivores, feed on the primary consumers or other secondary consumers. Omnivores can be primary or secondary consumers.

Decomposers and scavengers, such as bacteria, fungi, termites, earthworms and turkey vultures, feed on the organic material found in dead producers and consumers. Decomposers break down the organic material to nutrient levels. Nutrients in soils are essential for producers to grow. Thus, dead consumers and producers are recycled back into producers.

In every ecosystem various food chains are interconnected in a food web. Food chains and food webs indicate the eating patterns of the members of an ecosystem. Each component of the food web is necessary for the health of the ecosystem as a whole.

Any food web or food chain is a system that transfers energy from the sun. Each link in the chain depends on the link below it. Producers incorporate the sun's energy and in turn are eaten by herbivores, which are in turn eaten by carnivores (or omnivores). Ninety percent of the energy is lost at each transfer, explaining why there are so many more producers than herbivores and so many more herbivores than carnivores. A food pyramid, with producers at the bottom, primary consumers in the middle, and secondary consumers at the top, illustrates this concept.

The table below shows some organisms that live in the high desert of southeastern Utah.

Producers	Herbivores	Omnivores	Carnivores	Decomposers & Scavengers
Juniper	Piñon Mouse	Grey Fox	Mountain Lion	Turkey Vulture
Piñon	Antelope Ground Squirrel	Ringtail	Kit Fox	Termite
Rabbitbrush	Pronghorn (antelope)	Coyote	Badger	Beetle
Serviceberry	Chipmunk	Striped Skunk	Golden or Bald Eagle	Fly Larva
Blackbrush	Desert Cottontail	Raven	Great Horned Owl	Springtail
Prickly Pear Cactus	Mule Deer	Piñon Jay	Great Blue Heron	Millepede
Cottonwood	Desert Bighorn Sheep	Canada Goose	Canyon Wren	Earthworm
Algae	Hummingbird	Trout	Rattlesnake	Fungus
Cryptobiotic Soil	Grasshopper	Mosquito	Whiptail Lizard	Bacteria

PRE-TRIP ACTIVITY

Who is eating whom?

Adapted from Storer Camps 1988, 18

PROCEDURE

1) Define the terms *ecosystem*, *producers* and *consumers*. Have students name examples of living producers and consumers, and examples of non-living things.

2) Introduce food chains and discuss examples. Explain the rules of a game that involves a particular food chain: algae (producers), mosquitoes (consumers), lizards (consumers), and foxes (consumers). Explain that the object of the game is for each student, who will be assigned to be one of the three animals, to feed without getting caught. The mosquitoes eat only algae. The lizards eat only mosquitoes, and the foxes eat only lizards. Explain that, if tagged, a student must put any and all food into the sandwich bag of his captor, and he is out of that round of the game.

3) Go outdoors to an open, grassy area. Hand a name tag to each student. Scatter the algae energy pieces (marbles), give boundaries, and designate an area for "dead" animals to go. Begin the game with the entire class by releasing the mosquitoes first. Then release the lizards, and finally the foxes. Play for a few minutes until all of the students in one of the consumer groups are captured. Explain that in order for an organism to survive, it must have food. Ask the players to check their bags; if they do not have food, they cannot survive and they must go to the dead animal zone. Ask students if the number of survivors in this first game illustrates a balance of nature. Point out that in a balanced community, there are more plants (producers), than there are plant eaters (primary consumers) and more plant eaters than animal eaters (secondary consumers).

4) Begin the game again and play until just before one of the groups of consumers is completely captured. Divide the class into survivors and non-survivors. Students who were caught or who collected no food are non-survivors and those who have food are survivors.

5) Discuss the activity. Ask the students to predict answers to the questions: What would happen if there were not enough algae? In nature, what would happen to algae if there were no surviving mosquitoes? If there were no surviving lizards, what would happen to the mosquitoes and the algae? (The population of mosquitoes would increase, causing algae population to decrease. Foxes would starve). Review the items that students need to bring on the field trip.

OBJECTIVES

Students will be able to:

- Identify the components of a food chain.
- Define *producers*, *consumers* and *ecosystem*.

MATERIALS

- Marbles
- Approximately 15 *mosquito* name tags
- Approximately 7 *lizard* name tags
- Approximately 3 *fox* name tags
- Boundary markers
- Sandwich bags

TIME

- 35 minutes

PRE-TRIP

Objectives

Students will be able to:
- Describe a simple food chain.
- Name at least one producer, one herbivore and one carnivore.

Materials

- Yellow ball
- String
- Postcards or photographs of two or three each of producers, herbivores, omnivores, and carnivores
- Lunch trays with different compartments labeled *producers*, *herbivores*, and *carnivores*
- Small notepaper
- Pencils
- Clipboard
- Paper
- Marker

Time

- 30 minutes

STATION ONE

It's munch time!

Adapted from Van Matre and others 1987

PROCEDURE

1) Inform students that they are going to make a "munch line," or food chain. Place the yellow ball representing the sun in a tree, or have a parent hold it. The string represents the sun's energy that hits the earth. Pass out one postcard or photo to each student. Ask for those who think that they are producers, who get energy directly from the sun, to stand up. Briefly discuss each of their photos and have the group confirm that each organism is a producer. As each is confirmed, have them line up next to the sun, holding on to the string (energy) from the sun, and holding up their photos. Then ask for the herbivores to stand up, discuss each and confirm, and have them line up. Lastly ask for omnivores and carnivores, and discuss the difference. Have them line up. Direct them to make a c-shaped line, for best group viewing. Reinforce that energy is passed along down the line. Collect the postcards and photos.

2) Divide students into pairs, and distribute a "munch tray" (lunch tray) to each pair. Instruct students to explore a defined area and look for evidence of producers, herbivores (primary consumers) and carnivores (secondary consumers). Explain that their task is to load up the trays as high as they can, and that it doesn't matter if one compartment is fuller than another. Emphasize that they should gather whatever evidence they find, rather than looking for one particular category. Pass out notepaper and a pencil to each pair, and tell them they may write a note or draw a picture and put it in the tray if they see evidence that they cannot collect (a track or live animal, for example). Ask for ideas of evidence that might go in each compartment, then turn them loose. Circulate among the pairs, helping them to load up their trays.

3) Save five minutes to gather students and synthesize. Have each pair count how many pieces of evidence of producers they found, and tally these with hatch marks on the bottom of a sheet of paper on a clipboard. Tally the evidence of herbivores in the middle of the paper. Tally the evidence of carnivores at the top. The final tally should be pyramid-shaped . Briefly discuss the concept of a food pyramid and the idea that energy loss at each transfer creates this relationship.

EVALUATION

Ask students to create a drawing showing the energy chain from the sun to a carnivore.

Have students cut pictures out of magazines to create a collage of producers.

STATION TWO

All things dead or alive

PROCEDURE

1) Introduce decomposers, scavengers, nutrients, and the nutrient cycle. Discuss the Nutrient Cycle poster and the interaction of the nutrient cycle with an entire ecosystem.

2) Tell students that for the next game, they need to imitate a diversity of decomposers and scavengers. Show and have students practice the various poses or movements to go with the following commands:

- Caw like a raven.
- Arms up in a "V" like a turkey vulture.
- Wiggle like an earthworm.
- Chew like a termite.
- Stand up like a mushroom.
- Spin silk like a spider.
- Crawl like a beetle.
- Be small like bacteria.
- Jump like a springtail.
- Wave antennae like an ant.
- Inch along like a larva.
- Move like a millipede.

Play Cycle Says, in the manner of Simon Says. The goal of this game is to reinforce the diversity of decomposers, and to review their role in cycling nutrients.

3) Show pictures of decomposers and scavengers. Bring out the box of soil with decomposers in it. Explore the different kinds of decomposers present, using hand lenses. Observe the nutrient-rich soil and compare it to a handful of sand.

4) If you have time, play the Circle Cycle Game, in the manner of Duck, Duck, Goose. Have one student decide what decomposer or scavenger, or nutrient "cycler," he wants to be. Have that student take the "nutrients" (paper leaf), and walk around the outside of the circle. At some point the cycler drops the leaf behind a seated player, and runs around the circle. The seated player picks up the leaf, and runs after and attempts to tag the cycler. The cycler tries to get back to the spot where that player was seated without getting tagged. If the cycler is tagged, then she remains the cycler, takes back the nutrients (leaf), and begins the game again. If the cycler succeeds in sitting in the abandoned spot before getting tagged, the other player becomes the new cycler, keeps the leaf, and starts the next round of the game.

OBJECTIVES

Students will be able to:
- Describe the nutrient cycle.
- List three decomposer organisms.

MATERIALS

- Nutrient Cycle poster (draw cycle through *producers*, *primary consumers*, *secondary consumers*, and *decomposers*, back to producers. Illustrate by gluing a few magazine pictures of sample organisms adjacent to each word.)
- Pictures of decomposers and scavengers
- Box of nutrient-rich soil with different types of decomposers in it
- Hand lenses
- Big paper leaf

TIME

- 30 minutes

STATION 2

Objectives

Students will be able to:

- Discuss the interplay of population and food supply in a predator-prey relationship.
- List at least two causes of changes in the balance of nature.

Materials

- Predator and/or prey puppet
- Copy of story, "Gluscabi and the Game Animals" (Caduto and Bruchac 1988, 164-169)
- Blindfolds (for extension/variation activity)

Time

- 30 minutes

STATION THREE

Yum-Yum

PROCEDURE

1) Use a puppet such as a fox to discuss the concept of predators and prey. Introduce the idea of population fluctuations by having the puppet lament over what will happen to him and his friends if there aren't enough mice available.

2) Read "Gluscabi and the Game Animals." Discuss the story and its lessons. Ask why Grandmother Woodchuck told Gluscabi to put the animals back where they belong. Ask students what they think Grandmother meant by, "Things must be in the right balance." Discuss the fluctuation of populations and what happens when there are too many predators or too few predators. Discuss how a balance in nature is critical to a healthy ecosystem.

3) Instruct students in how to play the Predator-Prey Race. Draw two parallel lines, about ten feet apart, across a sandy open area. Have half of the group stand behind each line, facing each other. Draw another parallel line, marking a safe zone, approximately 25 feet behind each team. Assign a predator name to one team and its prey to the other. Instruct students to think quickly, then run to their safe zone if they are prey, or run after and try to tag the prey if they are predators. Any tagged prey join the predator team, and a new round begins. Start off with obvious predator-prey pairs, then proceed to trickier ones. Discuss any pairs that produce confusion, before the next round. Relate fluctuations in numbers of students on each team back to the previous discussion of population fluctuations. Examples include: *dragonflies/mosquitoes, owls/mice, spiders/insects, foxes/mice, mountain lions/mule deer, bald eagles/fish, bobcats/rabbits, coyotes/woodrats, mosquitoes/humans, spiders/flies, bats/mosquitoes, rattlesnakes/mice.*

EXTENSION/VARIATION

To emphasize the role of senses in predator-prey relationships, play Predator-Prey Circle (Cornell 1979, 58-59). Have students sit in a circle. Have a volunteer "predator" sit in the middle of the circle, blindfolded. Have that student name what type of predator she wants to be and what kind of prey she will hunt. Point silently to a student, who becomes that prey. The prey student then enters the circle on hands and knees. Tell the predator when the prey has entered the circle. The predator, also on hands and knees, then pursues the prey, using hearing. If the predator tags the prey and captures it, the prey becomes the next predator. If the predator does not catch the prey after a couple minutes, have another student become the predator. Start again.

STATION 3

STATION FOUR

The small world of bigfoot

PROCEDURE

1) Review the concept of an ecosystem, made up of all the living and non-living things in an area. Tell students that at this station they are going to focus on some of the very small components of the ecosystem. Walk students to a patch of cryptobiotic soil, and discuss its role in an ecosystem. Remind students to be very careful not to squash this soil during the explorations they are about to begin.

2) Explain that students will work in pairs, and that each pair will receive a Bigfoot frame to set down in a place of their choosing. Set boundaries for the activity. Ask students to make observations to answer the question: *How many different living things and how many different shapes can you find within a Bigfoot frame?* Instruct students to use hand lenses to get a close look at the area within their "foot," and to write down or draw the different shapes and objects that they observe on their **Bigfoot Micro-Ecosystem Observation Sheet**. Ask that students in a pair take turns writing or drawing on their sheet. Show them how to use a hand lens. Discuss their predictions or hypotheses of what they might find.

3) Have students pair up, and distribute a frame, sheet, clipboard, pencil and hand lens to each pair. Assist them in placing their frames and circulate to help them with recording observations. Have them label any recorded objects that they can identify.

4) Re-group students and have them share their results. Ask if they observed more living things or non-living things. Discuss the variety of shapes observed, and which shapes were the most common. Ask students to name conclusions, or things they learned during this science experiment. Tell students about the abundant microorganisms, too small for them to see, in the soil. Emphasize the variety of life found even on these very small plots. If you have extra time, explore the area for different textures, such as soft, fluffy, hairy, prickly, smooth, and bumpy.

Objectives

Students will be able to:
- Identify three shapes and name three objects found in a micro-ecosystem.
- Draw a conclusion from a scientific process.

Materials

- Bigfoot frames (cardboard frames cut in same foot shape as observation sheet, but 11/2 to 2 times as large)
- Copies of **Bigfoot Micro-Ecosystem Observation Sheet**
- Hand lenses
- Pencils
- Clipboards

Time

- 30 minutes

STATION 4

Bigfoot Micro-Ecosystem Observation Sheet

POST-TRIP ACTIVITY

Energy Sun tag

Adapted from Storer Camps 1988, 18

PROCEDURE

1) In the classroom, review the definitions of *producer*, *herbivore*, *carnivore*, and *omnivore*. Explain that students will be going outside to play a game. Tell students that they will each draw a role out of a hat: One student will become the sun, several students will be plants, some will be herbivores, a few will be omnivores, and a couple will be carnivores. Review the concept of the food pyramid as explanation for the relative numbers of the different types of name tags.

2) Have students pick name tags, and explain their roles. The sun will stand in one place and hand out energy (marbles) to the plants. Whenever a plant is out of energy, she must go to the sun, and the sun should give her four marbles. When the plants have energy, they run away from the animals trying to catch them. Herbivores try to tag plants to get food. When a plant is tagged, she must hand over one energy marble to her captor and one marble to a cup (which an instructor will be holding) to represent "used-up" energy. Explain that not all energy is passed along the food chain; much of it is used up along the way. Carnivores try to tag herbivores for food. When an herbivore is tagged, he must also hand over one marble to his captor and one to the cup. Omnivores may tag either plants or herbivores. Explain that some bases will represent animal homes. Any animal may go to one of these and be safe from capture, but cannot stay there for more than ten seconds. All animals will start at one of the homes at the beginning of the game.

3) Go outside to a large open area with a soft surface. Clearly define boundaries, and designate animal homes. Give all the energy marbles to the sun, and start the game.

4) Have students freeze to discuss what has happened so far. Are any animals starving? Remind students to give up one marble for used-up energy at each capture. Continue the game.

5) Stop the game. Have students sit in a circle or back in their classroom. Ask how many of the animals had energy marbles at the end of the game, and explain that the others represent animals that starved. Discuss and review concepts and definitions pertaining to the game.

EVALUATION

Have students create a large wall mural depicting a food web found in their backyards. Ask students to create a form of Energy Sun Tag using actual food for energy (e.g., popcorn).

OBJECTIVES

Students will be able to:
- Describe a food pyramid.
- Define the terms producer, herbivore, carnivore and omnivore.

MATERIALS

- Boundary and home base markers
- Name tags for the *sun*, *plants*, *herbivores*, *omnivores* and *carnivores*
- Marbles in a large cup
- Cup for "used-up" energy

TIME

- 35 minutes

POST-TRIP

References and Resources

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